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EXERCISE TREADMILL SALINE CONTRAST ECHOCARDIOGRAPHY FOR THE DETECTION OF PATENT FORAMEN OVALE IN HYPOXIC PATIENTS

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Background: Percutaneous patent foramen ovale (PFO) closure improves hypoxia and dyspnea in selected patients with PFO-mediated right-to-left shunt (RLS). Agitated saline contrast echocardiography (SCE) performed at rest is frequently used to identify PFOs in hypoxic patients. SCE performed with exercise may produce hemodynamic and anatomic changes that result in RLS and associated hypoxia not present during at rest. We sought to determine if exercise SCE outperformed resting SCE for the detection of PFO-mediated RLS using intracardiac echocardiography (ICE) and PFO catheter probing as a gold standard.

Methods: Thirty three patients with either resting or exercise-induced hypoxia and suspected PFO-mediated RLS underwent rest and exercise SCE, right heart catheterization, ICE, and PFO probing between 2007 and 2010. SCE and ICE images were reviewed retrospectively. A positive SCE study was defined as visualization of saline contrast in the left heart post brachial vein injection. Shunt timing was determined by the cycle at which targets first appear in the left heart following right atrial opacification at rest and post-exercise. PFO with RLS was defined as ICE identification of 1) PFO anatomy 2) right-to-left color Doppler and bubble flow through a PFO and 3) catheter passage across the PFO.

Results: Twenty two patients (67%) had positive SCE and 25 (76%) had positive exercise SCE. A total of 26 (79%) patients met invasive criteria for PFO mediated-RLS. Exercise SCE demonstrated optimal performance using a 3 beat cut-off post right atrial opacification with area under of the curve (AUC) of .77, a sensitivity of 73%, specificity of 86%, positive predictive value of 95%, and negative predictive value of 46%. In contrast, resting SCE performed optimally using a 4 beats cut-off with an AUC of .70, sensitivity of 69%, specificity of 86%, positive predictive value of 95%, and negative predictive value of 43%.

Conclusion: When compared to resting SCE in a hypoxic cohort with suspected PFO-mediated RLS, exercise SCE demonstrated superior AUC, sensitivity, and negative predictive value with equivalent specificity and positive predictive value. Exercise SCE may play a role in screening for PFO mediated-RLS.